Natural Gas Delivery Reliability

Program Overview
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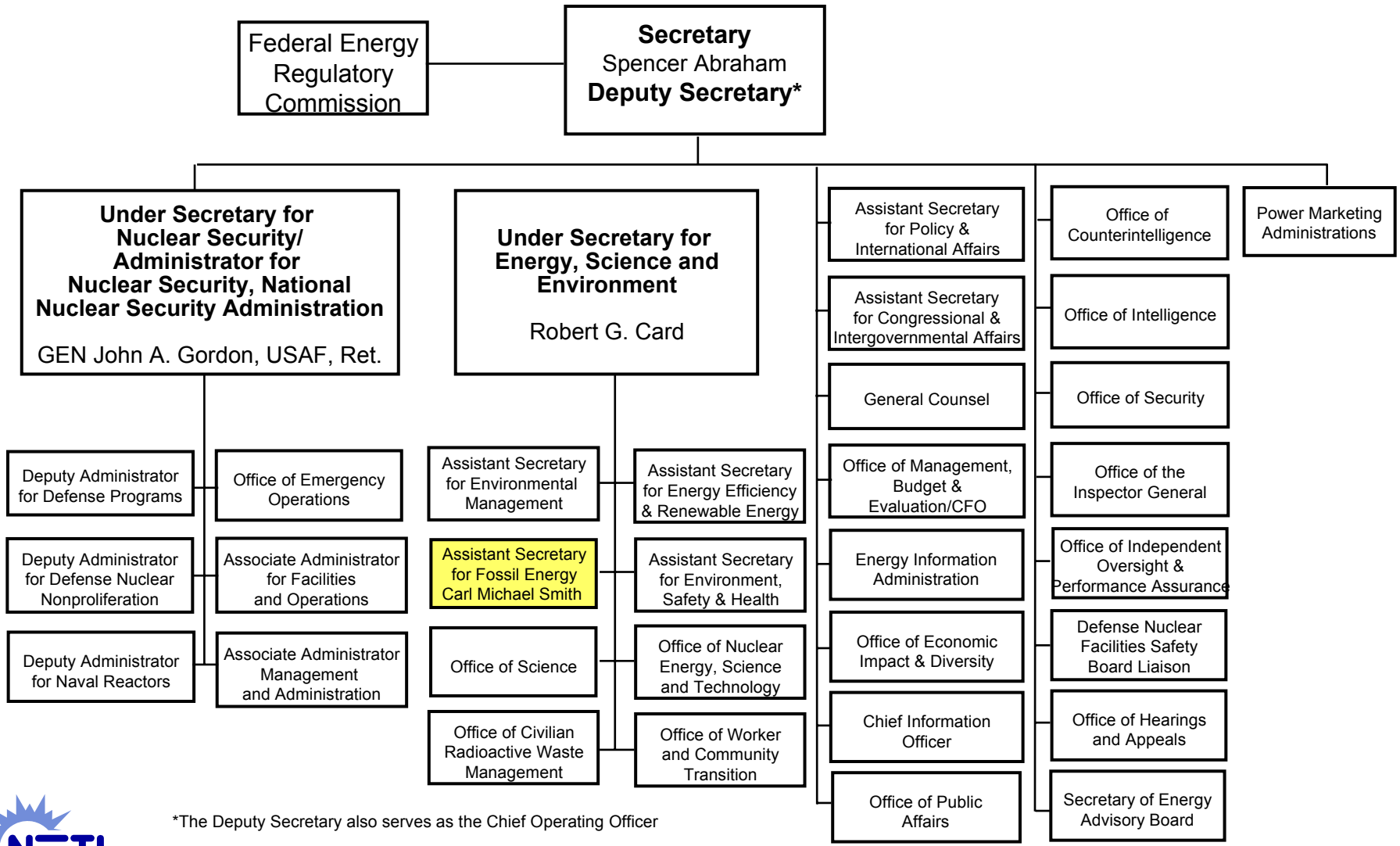
Dr. Rodney J. Anderson
Product Manager

Strategic Center for Natural Gas

Department of Energy



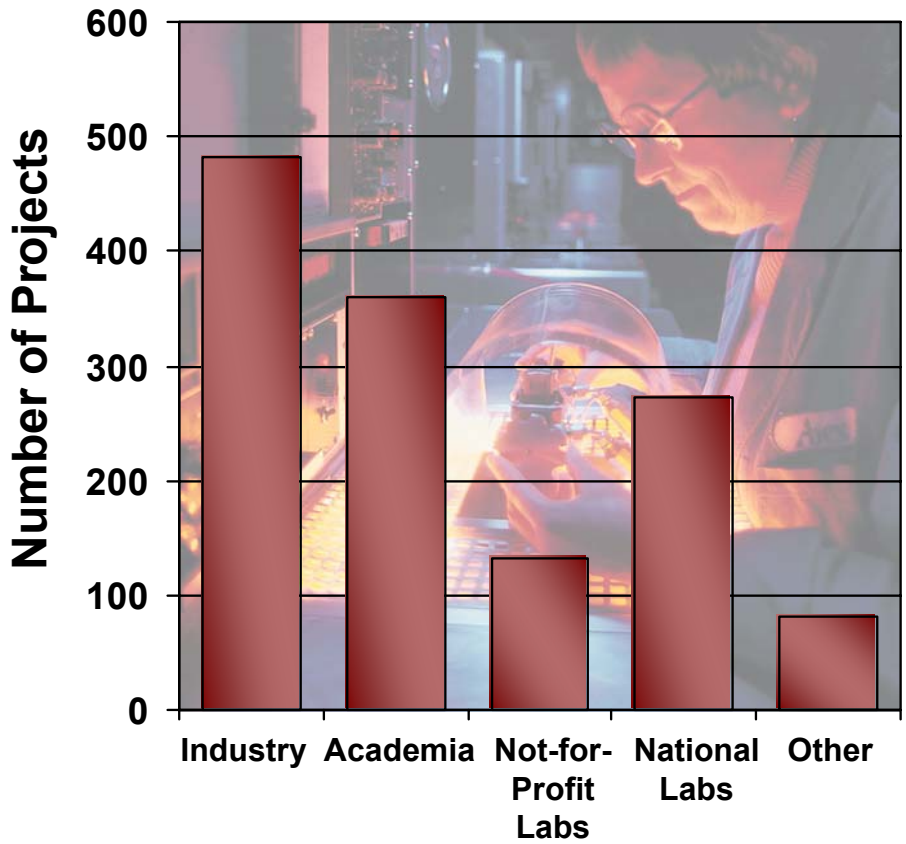
*The Deputy Secretary also serves as the Chief Operating Officer

National Energy Technology Laboratory

- One of DOE's 17 national labs
- Government owned/operated
- Sites in Pennsylvania, West Virginia, Oklahoma, Alaska
- More than 1,100 federal and support contractor employees
- FY 03 budget of $750 million

Shape, Fund, and Manage Extramural RD&D

- **1,300 research activities in all 50 states and several foreign countries**
- **Total award value $7.3 billion**
- **Private sector cost-sharing of $3.6 billion**
  - Leverages DOE funding
  - Ensures relevance
  - Accomplishes mission through commercialization



NETL Plays Key Role in Fossil Energy Supply, Delivery, and Use Technologies

Electric Power Using Coal

Coal Production

Environmental Control

V21 Next Generation

Carbon Sequestration

Clean Liquid Fuels

Exploration & Production

Refining & Delivery

Alternative Fuels

Future Fuels

Natural Gas

Exploration & Production

Pipelines & Storage

Fuel Cells

Combustion Turbines

Photo of hydrogen fueled car: Warren Gretz, NREL

Strategic Center for Natural Gas

Vision:

By 2020, U.S. public is enjoying benefits from an increase in gas use:

- **Affordable supply**
- **Reliable delivery**
- **Environmental protection**

Mission:

Be the focal point for an integrated gas program:

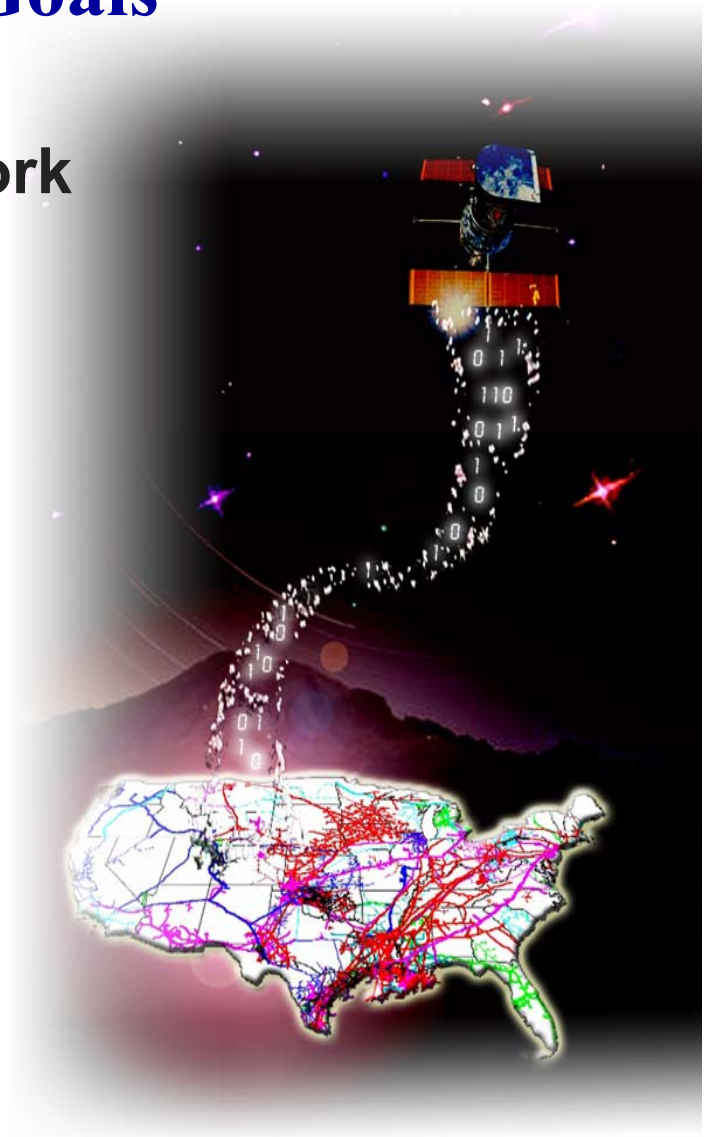
- **Spearhead annual DOE-wide gas RD&D planning and program assessment**
- **Provide science and technology advances through NETL's on-site programs**
- **Shape, fund, and manage extramural RD&D**
- **Conduct studies to support policy development**

Gas Infrastructure Reliability

- **Transmission, distribution & storage**
- **Program goals**:
  - Maintain/enhance system reliability and integrity
  - Increase gas deliverability
  - Reduce environmental impact
  - Address gas & electric interdependencies
  - Develop technology for future gas delivery system
  - Support infrastructure security
- **Budget: FY03**
  - $2 million storage technology
  - $7 million infrastructure reliability

Infrastructure Goals

- **Establish the technology framework for our Nation's future secure natural gas transportation and delivery system**
  - Provide research and technology development
  - Focus federal infrastructure program on public benefit R&D
  - Collaborate with private sector
  - Support infrastructure assurance



Infrastructure Activities

Interagency Workshop
March 22 & 23, 2000 Washington, DC
DOE, DOT, FERC, EPA, DOI

Visioning Workshop
May 3, 2000 Pittsburgh, PA
15 industry executives

Roadmapping Workshop
June 6 & 7, 2000 St. Louis, MO
40 industry experts

Roadmap Update Workshop
January 29 & 30, 2002 Pittsburgh, PA
40 industry experts

Industry Forum
September 16 & 17, 2002
Morgantown, WV
100 attendees

Workshop Goals
Elicit stakeholder input
- Vision
- Technology needs & opportunities

Determine government role

National Lab Calls
1 each fiscal year
Focus on innovation

Competitive Solicitations
1 each fiscal year
Various stages of development

Broad-Based Financial Assistance Solicitations
Participated each year
Various stages of development

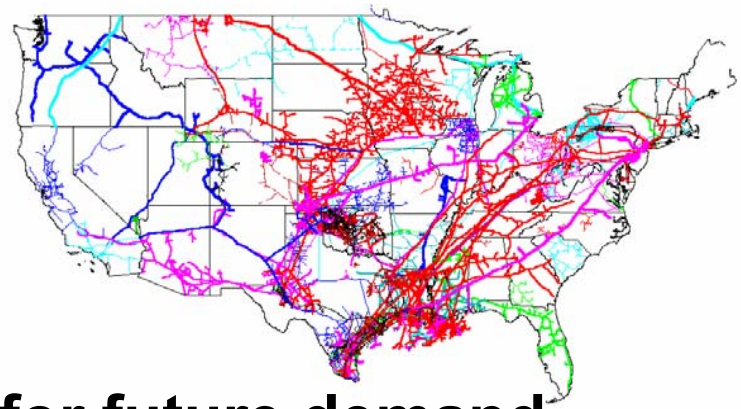
Natural Gas Industry Background

- 270,000 miles of transmission pipelines*
- 952,000 miles of distribution pipelines*
- $8 billion/yr investment in infrastructure*
- Energy companies dominating the industry
- R&D viewed as expense, not investment
- FERC-funded R&D loss
- Growing DOE role in infrastructure R&D
- Security difficult with dispersed assets

*NPC Report, December 1999

Infrastructure Drivers

- Gas demand increase by 54% (to 36 tcf) by 2025 *
- Electric generators demand for gas to double (grow by 5 tcf *)



- Aging infrastructure inadequate for future demand
- Consolidation and competition limits gas industry investment in long-term public benefit R&D
- Distributed power drive infrastructure changes
- Gas *critical* for U.S. climate change strategies
- Increasing environmental sensitivities
- Heightened security concerns

*Annual Energy Outlook 2003

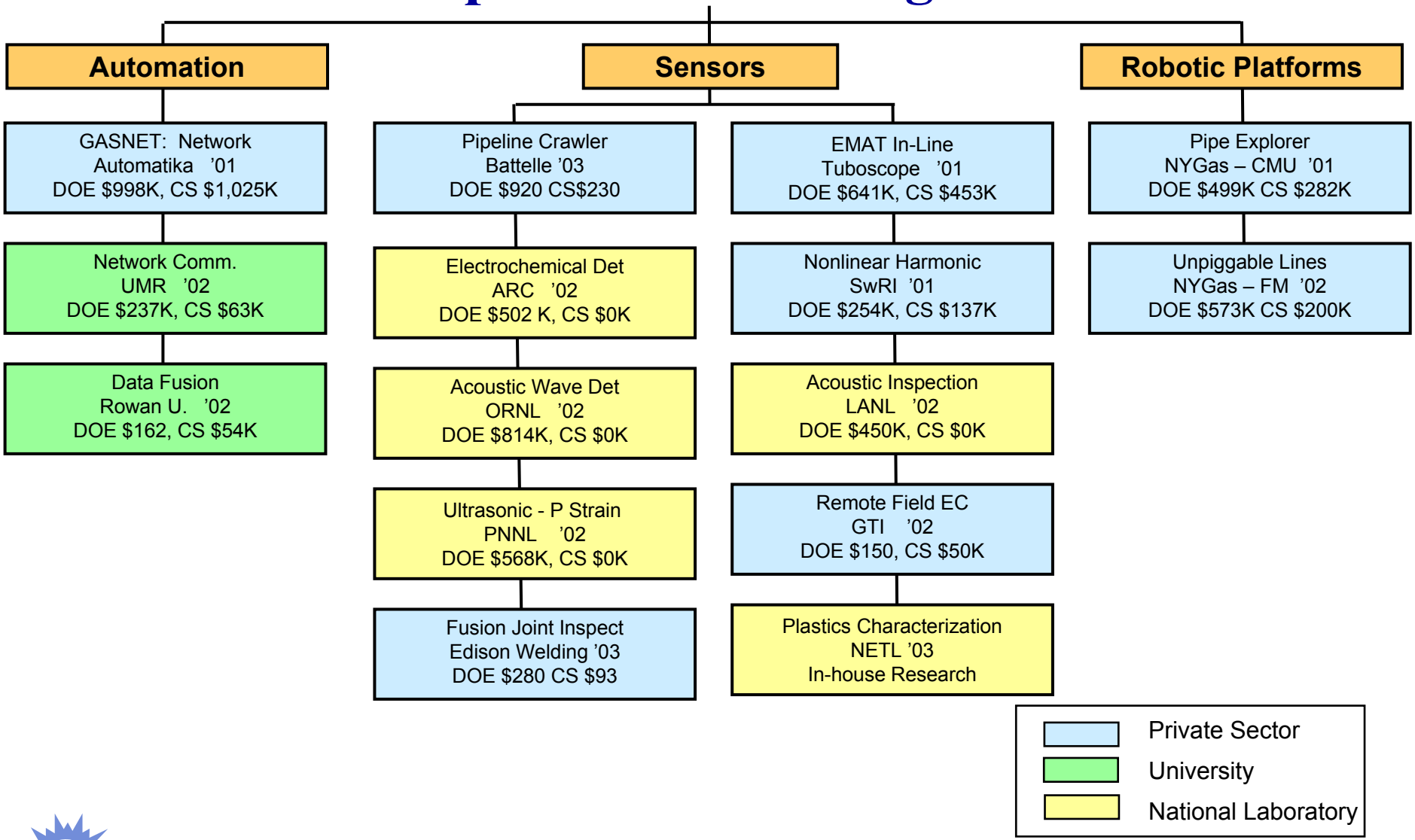
Core Areas & Issues

- **Inspection Technologies**
  - Robotic platforms
  - Sensors
  - Pigs
  - Automation
- **Remote Sensing**
  - 3rd party damage
  - Underground imaging
  - Leak detection
- **Materials**
  - Repair
  - Smart Pipe
  - Liners
- **Operational Technologies**
  - Compressors
  - Modeling
  - Corrosion

Inspection Technologies

Develop and integrate innovative sensors to provide enhanced assessments of the status of transmission and distribution facilities. These sensors will be applied in or near the pipe. This includes sensors to detect corrosion defects, stress corrosion cracking, plastic pipe defects, physical damage areas, gas content, gas contamination, and 3rd party intrusion near gas line right-of-ways and facilities as well as development and enhancement of robotic platforms used for pipeline inspection and other related activities.

Inspection Technologies

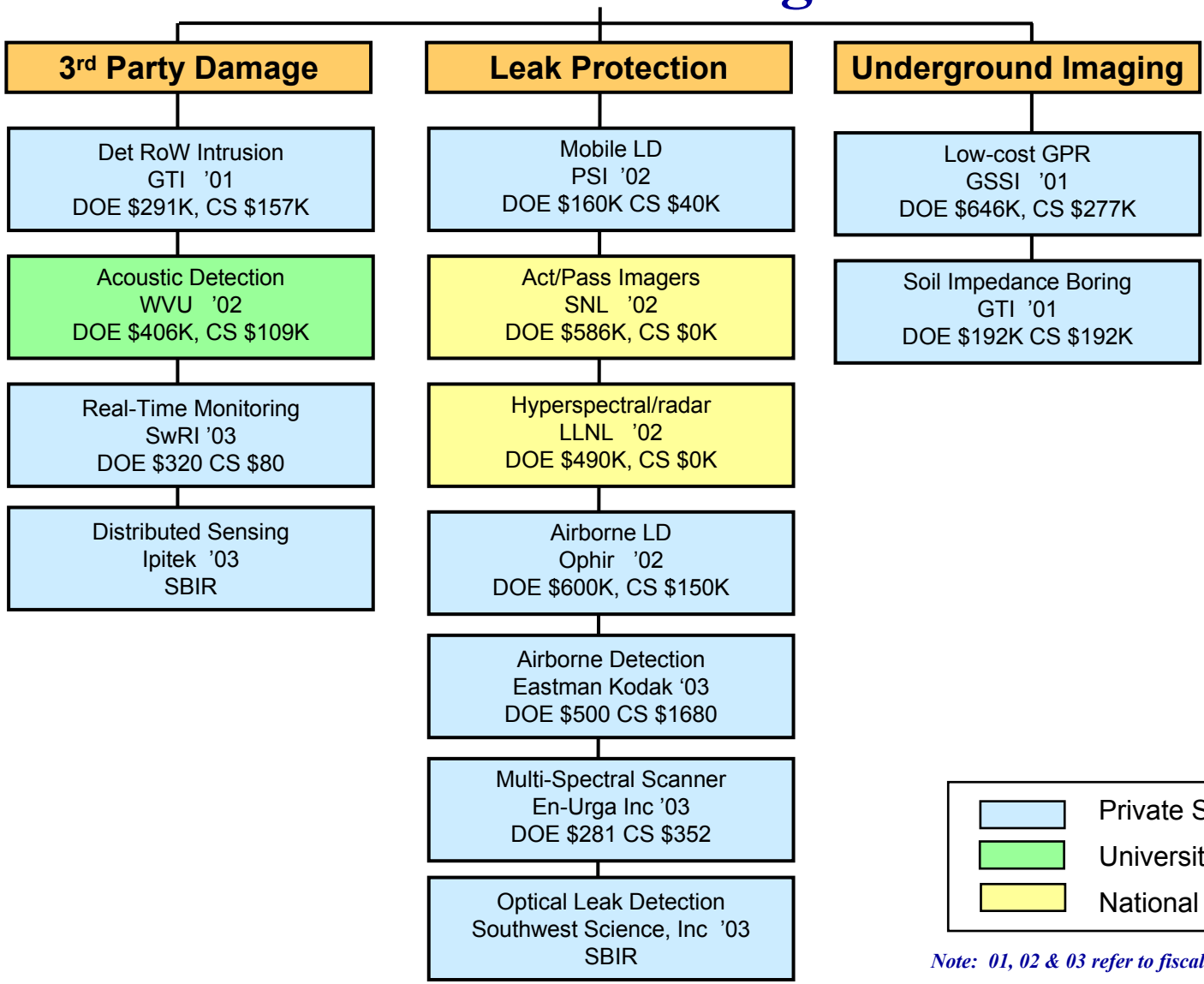


Note: 01, 02 & 03 refer to fiscal year of award

Remote Sensing

Develop advanced technologies to detect and identify 3rd party intrusion near gas line right-of-ways and facilities, detect and image metallic and non-metallic underground facilities, detect and quantify natural gas leaks, and other pertinent applications. Remote sensing is expected to be associated with very mobile platforms that can cover extended regions of the facilities quickly. Next generation natural gas leak detection and quantification is expected to focus on very high altitude (>50,000 feet) applications to allow improved, cost effective assessment.

Remote Sensing



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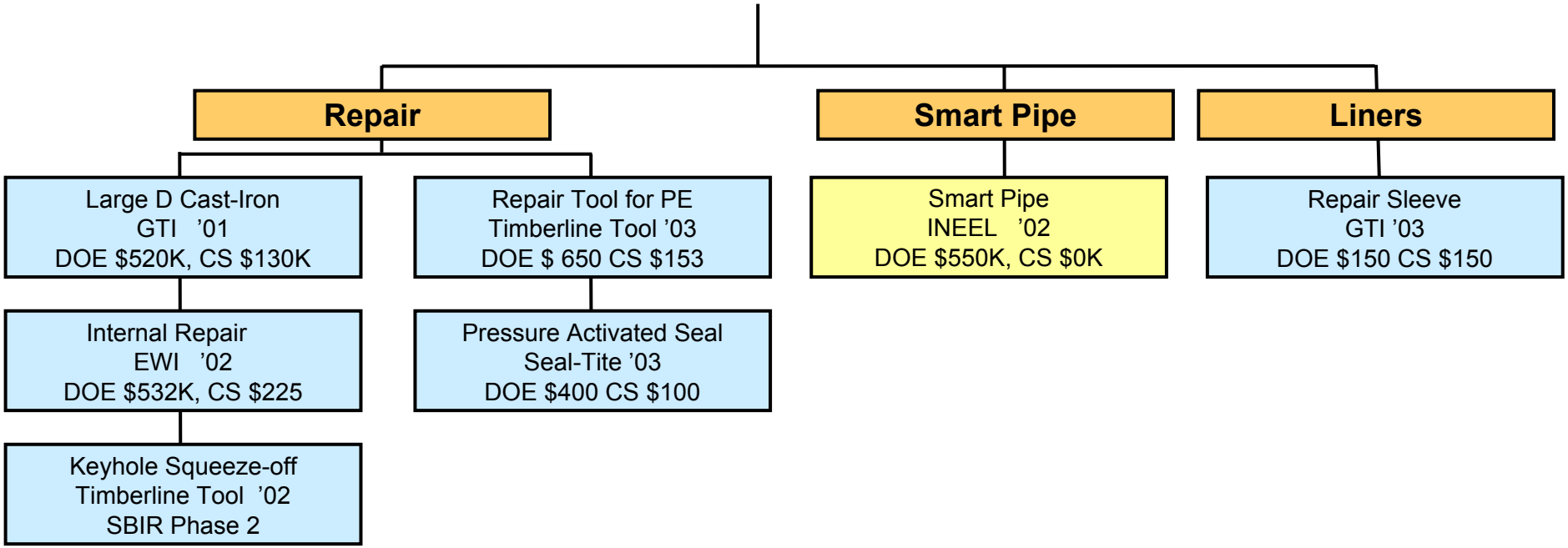
Materials Development

Develop smart pipe and in-situ repair technologies for both metal and plastic pipe. Smart pipe technologies include the ability of the pipe to sense damage or other threats to its integrity and provide responses that could range from notification of operators to self-repair, and other capabilities. Repair technologies or tools may be associated with their own mobile platforms for implementation or with robotic platforms developed in for inspection platforms.

Materials Development



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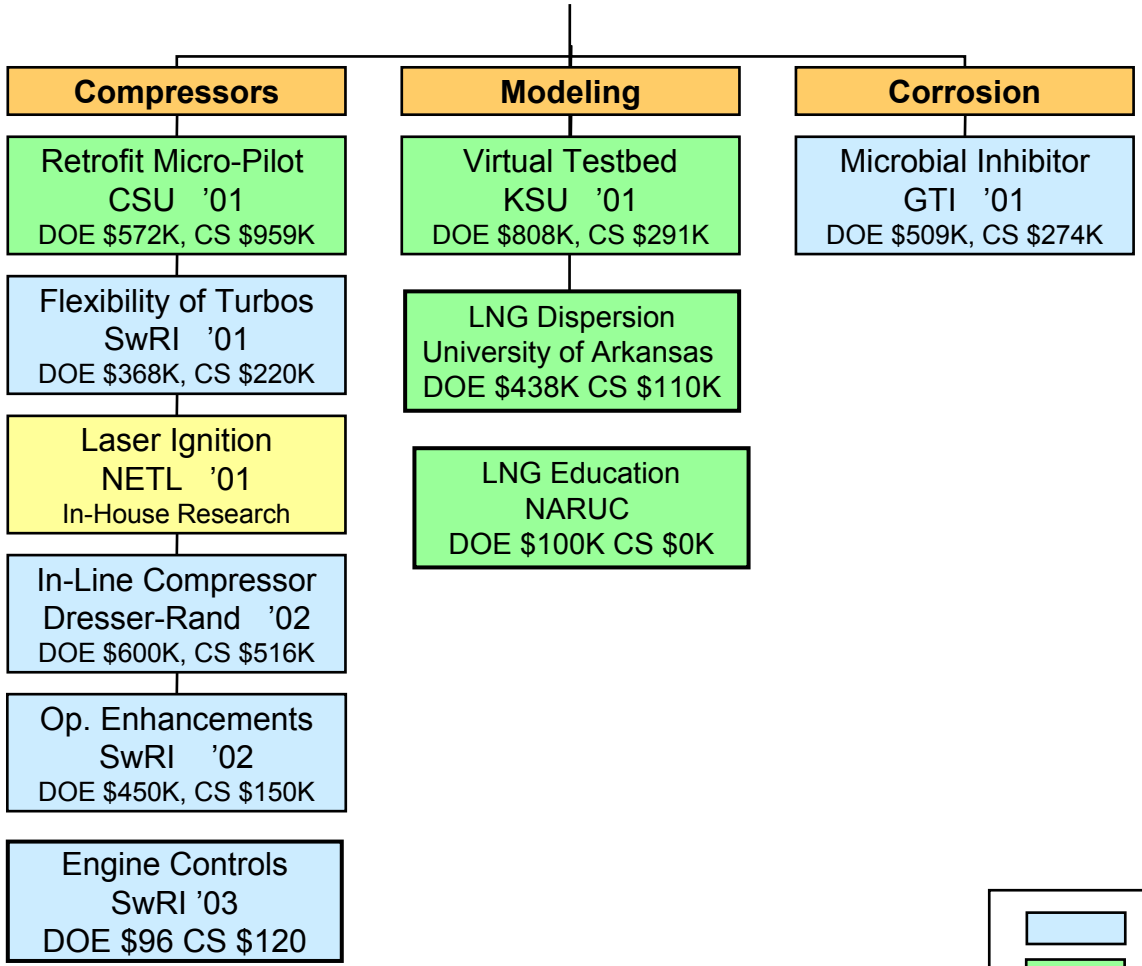
Operational Technologies

Develop next generation technologies and methodologies that improve the efficiency, reliability, and integrity of transmission and distribution operations. This includes the development of techniques to prevent corrosion or other forms of pipe deterioration, methodologies to optimize system operations to increase capacities of existing facilities, next generation compressors as well as substantial improvements in extant compressors, and other related activities.

Operational Technologies



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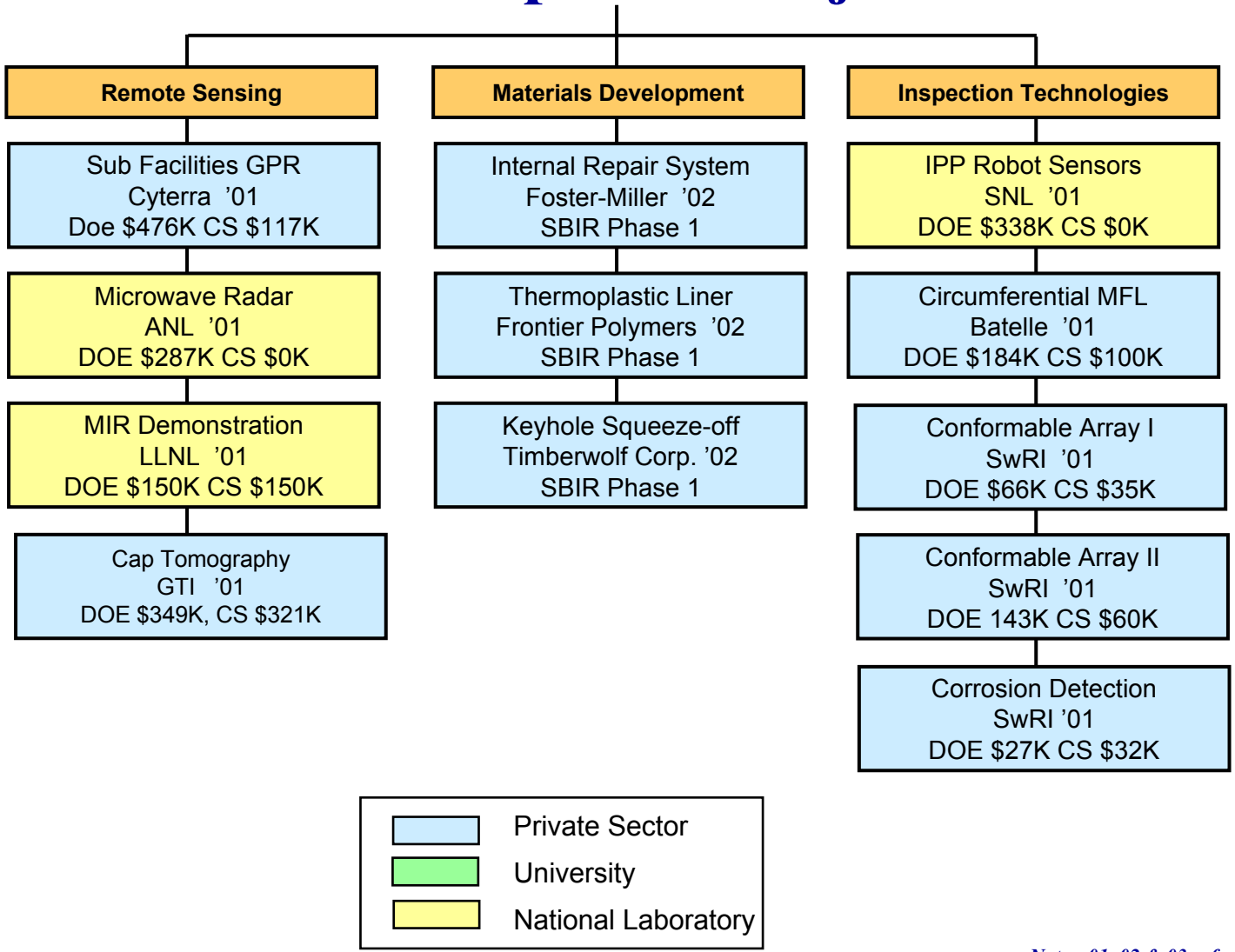
Completed Projects



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***Internet Location*: netl.doe.gov/scng/index.html**

Delivery Reliability Players/Efforts

Universities, National Labs, Industry